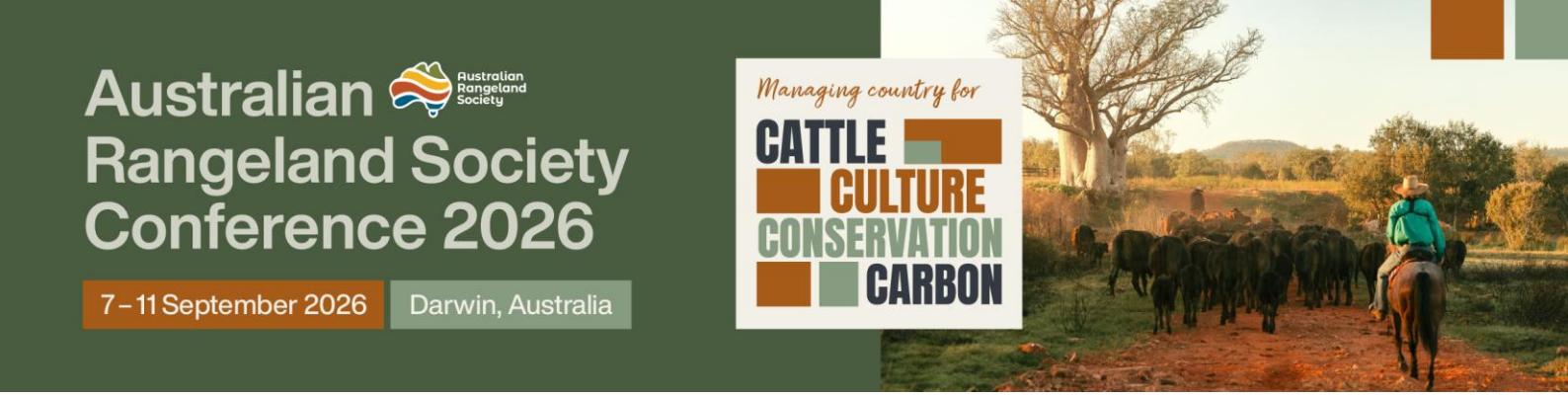

DRAFT PROCEEDINGS

23rd Biennial Australian Rangeland Society Conference

EDITORS

Gary Bastin, Dionne Walsh, Sarah McDonald, Margaret Friedel, Ian Watson, Adam Liedloff

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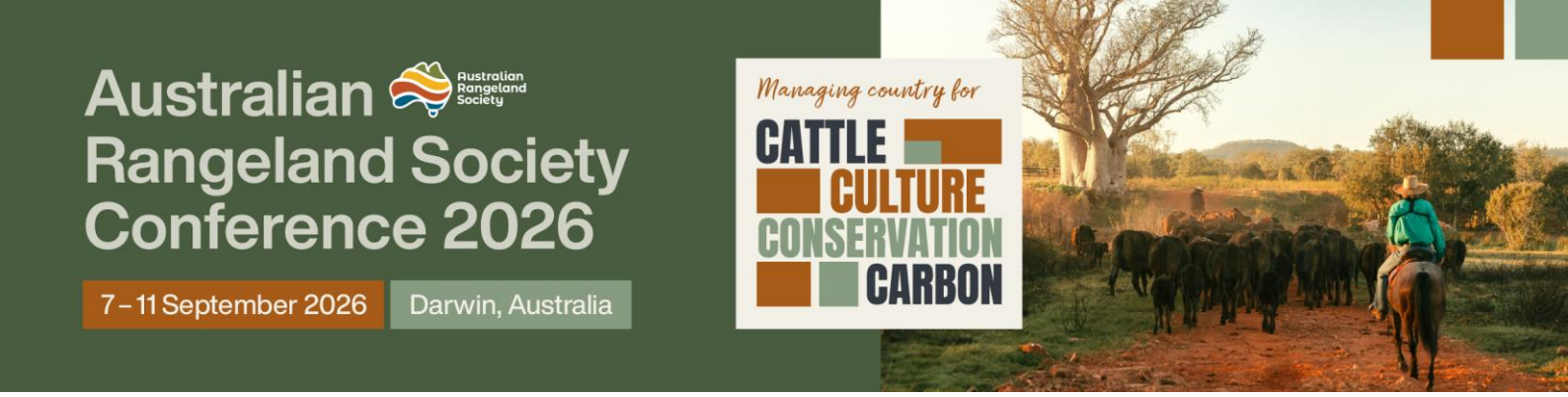

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The Australian Pastures Genebank: unlocking native genetic resources for rangeland restoration and research

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Abstract
Australian rangelands are subject to increasing climatic variability and declining pasture condition, necessitating improved resilience and productivity with minimal reliance on external inputs. The Australian Pastures Genebank (APG) serves as the national centre for pasture and forage genetic resources, conserving the biodiversity vital to Australia's agricultural and rangeland systems. Within its collection, the APG has identified 2,675 native accessions representing 407 species, including 1,828 that are georeferenced with precise latitude and longitude data. This collection of native seeds is unique, with no duplication in other international genebanks, providing a foundation for research, restoration, and sustainable pasture development.

Germplasm held in the APG were linked to a curated, native-only dataset derived from historical pasture evaluation trials across 48 sites in Queensland, the Northern Territory and New South Wales. The dataset includes observations of establishment, persistence, drought tolerance, grazing response and biomass production. Integration of germplasm resources with historical datasets provides a resource for targeted evaluation under current climatic conditions. By combining conservation, data sharing, and applied research, the APG supports national and international work in rangeland restoration and the advancement of climate-resilient agriculture.

Introduction

Livestock production in Australian rangelands is constrained by low soil fertility, high interannual variability in rainfall and episodic disturbance (Westoby et al. 1989). Efforts to increase productivity have historically focused on introduced pasture species, particularly tropical legumes, which increase carrying capacity through nitrogen inputs and increased biomass production (Pengelly and Conway 2000; Pengelly et al. 2010). However, establishment and persistence of these species is often inconsistent under marginal conditions, particularly in the arid zone of Australia (Clem 2007).

Native pasture species are adapted to the environmental constraints inherent to rangeland systems and may offer improved persistence under variable conditions (Whalley et al. 2013; Linder et al. 2018), reflecting the importance of maintaining genetic diversity and adaptive capacity under increasing climatic variability (Sgrò et al. 2011). Native legumes are of particular interest, as nitrogen limitation is a primary constraint on productivity in many northern systems (Pengelly and Conway 2000). Native plants are also sought for projects where landscape restoration is the primary focus. However, limited access to local indigenous germplasm (Whalley et al. 2013) and fragmented evaluation data have constrained their use.

The Australian Pastures Genebank (APG) maintains a large collection of pasture germplasm, including a substantial proportion of native species, many of which have not yet been classified according to their Australian origin. Historical evaluation trials undertaken across northern Australia generated large volumes of data on pasture performance, but until recently these data were not systematically integrated, and links to current APG accession identifiers were difficult.

This study identifies native taxa and associated characterisation and performance information in a curated, accessible dataset linked to germplasm that can be ordered as seed or plants propagated from vegetative clones from the APG, enabling re-evaluation of native species in rangeland systems.

Materials and methods

Native taxa were identified by within the APG using GRIN Global records which describe native species distribution (USDA 2026). Only accessions collected in Australia was included in the data set. The taxon was then checked with The Atlas of Living Australia and associated web-links (Belbin et al. 2021). Accessions were classified as native where species occur naturally in Australia and were collected within Australia, resulting in 2,675 accessions spanning 133 genera.

A historical dataset of pasture evaluation trials conducted between 1969 and 2001 across Queensland, the Northern Territory and New South Wales were digitised and curated. The dataset was filtered to include native species only, resulting in observations across 48 sites. Traits recorded include establishment, persistence, drought tolerance, grazing response and biomass production. To provide context for the relationship between germplasm availability and evaluation data, a summary of seed availability, geographic origin and observation records was derived from APG datasets (Table 1).

Results and discussion

The APG native germplasm collection encompasses a broad range of taxa representing several functional groups, particularly legumes and shrubs. Ongoing regeneration within the APG program is increasing seed quantity and viability to make seed available for distribution and further improving access to priority taxa.

The spatial distribution of evaluation sites spans a range of tropical and subtropical environments, providing a basis for assessing environmental adaptation (Figure 1). Shrub taxa, particularly old man saltbush (*Atriplex nummularia*), are well represented with a broad diversity of collection origins and associated evaluation datasets. Legume groups, including *Cullen*, *Glycine* and *Desmodium*, are also well represented presenting an opportunity for grazing systems to benefit from biological nitrogen fixation in low-fertility environments. However, observation coverage remains uneven among taxa, limiting direct comparison of performance across environments.

Limited observation records for some functional groups, particularly grasses and forbs, largely reflect historical patterns of evaluation and curation rather than an absence of agronomic potential. Characterisation during current seed regeneration activities is reducing the 'data gap' but the results reflect plant growth traits rather than adaptation to particular land types.

Grasses are broadly represented across both temperate and tropical environments, but evaluation data remain limited for many taxa (Table 1). Where observations are available (e.g. *Dichanthium*, *Chloris* and tropical grasses), they indicate variation in adaptation across environmental gradients and support their role in persistence and ground cover within rangeland systems. Such variation is consistent with broader patterns of ecological and evolutionary adaptation observed across grass-dominated biomes (Linder et al. 2018).

The regeneration of germplasm and upscaling for adoption requires the development of seed production methods, particularly in grasses where there are a range of seed structures and reproductive characteristics which impede seed crop development and harvesting (Loch et al. 1996). APG staff have developed seed production, harvesting and processing methods for key grass genera (*Dichanthium*, *Heteropogon, Themeda*) which show seed cropping is possible to complement wild harvesting within some taxa (Cox et al. 2008).

Conclusions

The APG provides access to a substantial resource of native germplasm with previously limited utilisation due to poor accessibility of propagative materials and associated evaluation information. By linking conserved germplasm with curated historical datasets the APG enables clients to access previously dispersed and inaccessible information. Combined with progressive regeneration, the APG is enabling a more systematic and evidence-based approach to the use of native genetic resources for rangeland restoration and research. This work contributes to the Australian Seed Bank Partnership (2026), a national network coordinating seed conservation, research and data sharing to support restoration and resilience of Australian ecosystems.

Table 1. Summary of native Australian germplasm conserved in the Australian Pastures Genebank for selected taxa and functional groups, including collection origin range, availability and safety backup status. The results presented account for 98.5% of the native germplasm held in the APG; species with lower numbers of accessions are grouped together.

Group	Climate	No. Access.	Min Lat	Max Lat	Min Long	Max Long	No. Safety dup.	Obs. data	No. Avail.
Forbs									
OMS*	C / A	295	-35.18	-23.32	134.23	147.35	37	3874	249*
other herb	C / A	117	-42.87	-18.45	113.67	151.15	22	-	20
other shrub	C / A	495	-42.95	-19.66	113.67	151.15	96	42	83
Grasses									
Anthosachne	C	98	-37.77	-27.42	139.34	151.95	4	-	7
Microlaena	C	24	-38.49	-36.36	141.11	146.64	7	-	17
Rytidosperma	C	51	-38.58	-31.43	135.65	148.37	11	-	38
Themeda	C / A	77	-38.67	-16.67	130.72	152.29	10	-	10
Other: temperate	C	78	-38.75	-26.53	116.21	148.88	20	-	47
Bothriochloa	A	20	-36.39	-26.95	136.63	150.16	2	38	15
Chloris	A	24	-37.54	-25.03	132.25	150.2	2	15	21
Dichanthium	A	40	-36.31	-18.88	132.12	151.74	14	19	36
Other: tropical	A	234	-38.75	-14.82	119.49	152.89	58	156	126
Legumes									
Cullen	C / A	209	-38.02	-20.2	115.88	152.93	121	256	143
Lotus	C / A	114	-37.57	-21.56	114.64	151	17	12	33
Other temperate	C	152	-38.42	-23.63	114.73	153.12	58	-	46
Trigonella	C	19	-31.45	-25.95	117.7	143.82	14	55	16
Desmodium	A	43	-36.08	-12.58	140.7	153.57	14	55	35
Glycine	A / C	264	-38.36	-12.7	116.59	153.37	138	20	75
Sesbania	A	98	-28.49	-15.6	113.66	152.76	53	-	69
Other tropical herb	A	111	-37.82	-11.5	132.33	152.86	100	160	142
Other tropical shrub/tree	A	73	-42.85	-14.45	116.67	151.64	38	7	7
Total		2636					834	4709	1235

Climate: C = Temperate, A = Tropical; No. Access. = Total number of accessions for that group; Min lat = northernmost latitude a representative was sourced from; Max lat = southernmost latitude a representative was sourced from; Min. long = westernmost longitude a representative was sourced from; Max long = easternmost longitude a representative was sourced from; No. Safety dup. = Number of duplicates held as a reserve; Obs data = Number of observation records available for that group; No. Avail. = Number available for distribution, * Old Man Saltbush (OMS) available as vegetative cutting from living nursery.

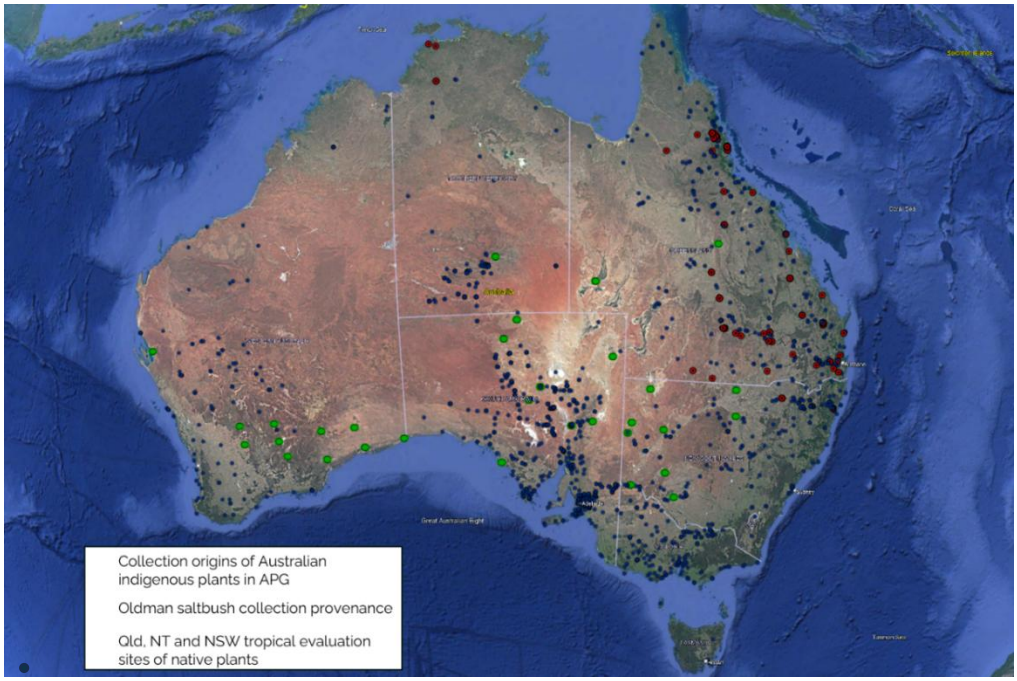

Figure 1. Distribution of collection origins and tropical evaluation sites for Australian native plants held in the Australian Pastures Genebank

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